No. 812,353. PATENTED FEB. 13, 1906.

J. F. MURPHY.

STEAM ENGINE.

APPLICATION FILED MAR. 29, 1905.

3 SHEETS—SHEET 1.

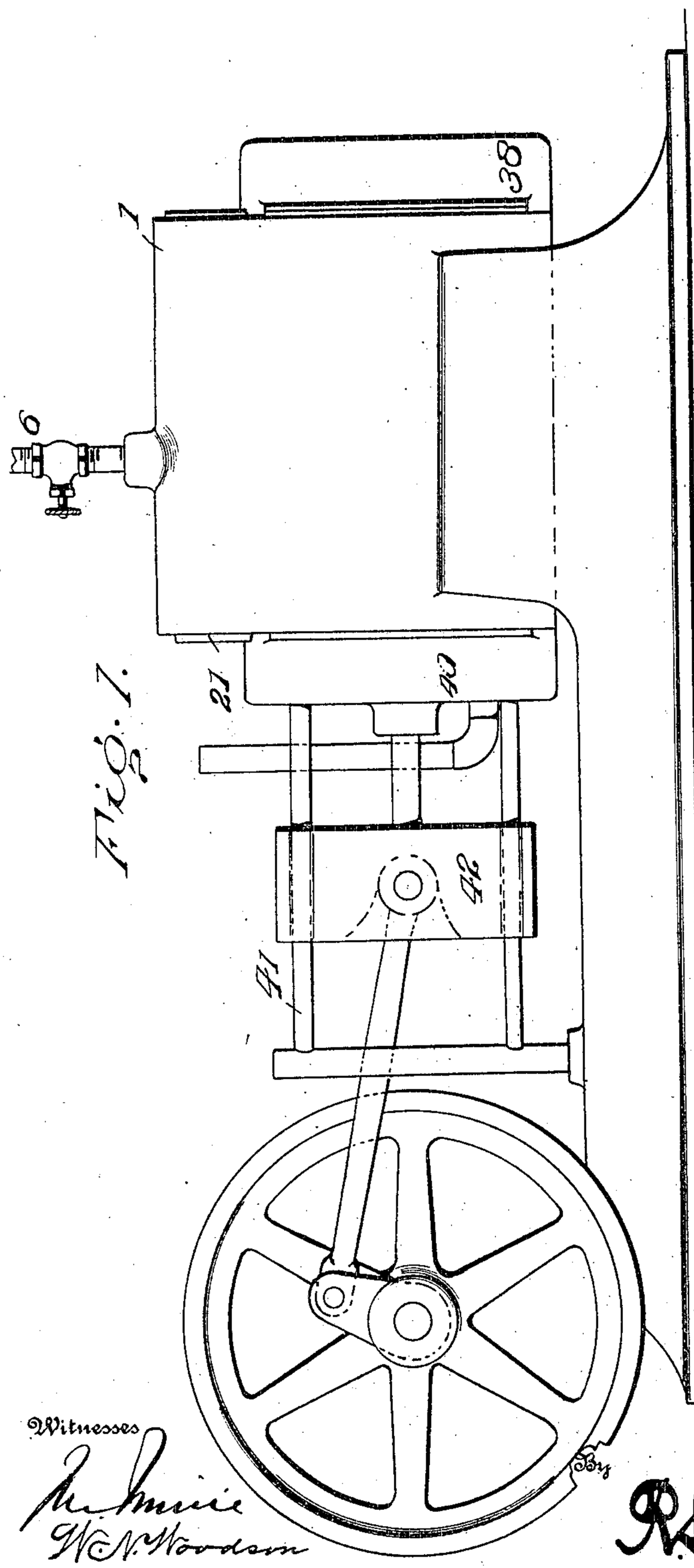

Fig. 1.

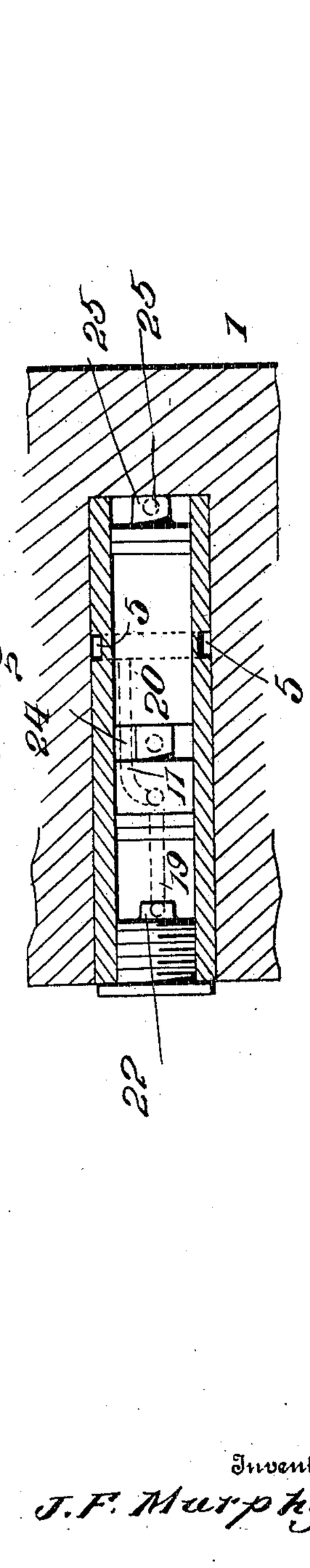

Fig. 2.

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3 SHEETS—SHEET 2.

FIG. 2

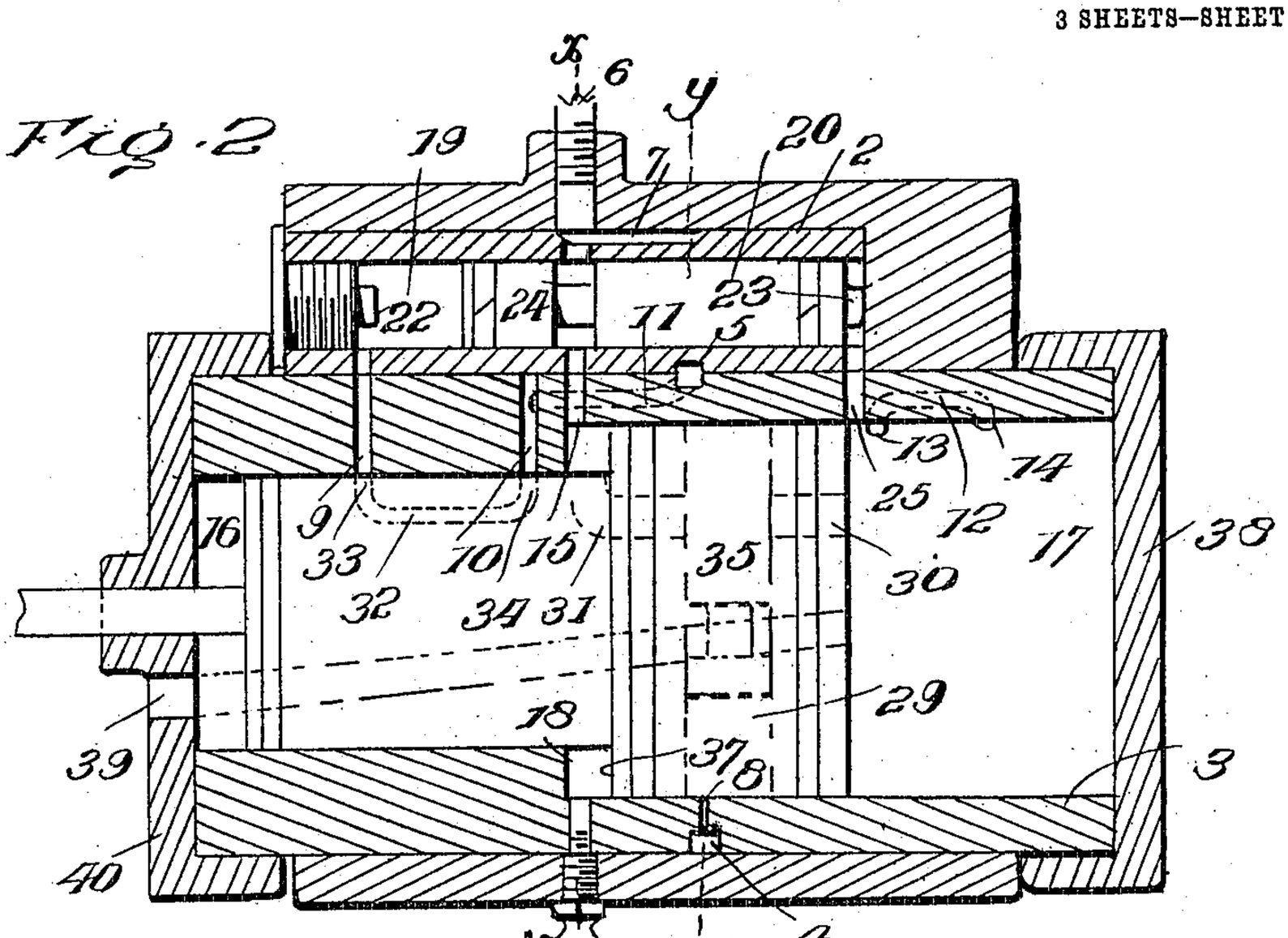


FIG. 3

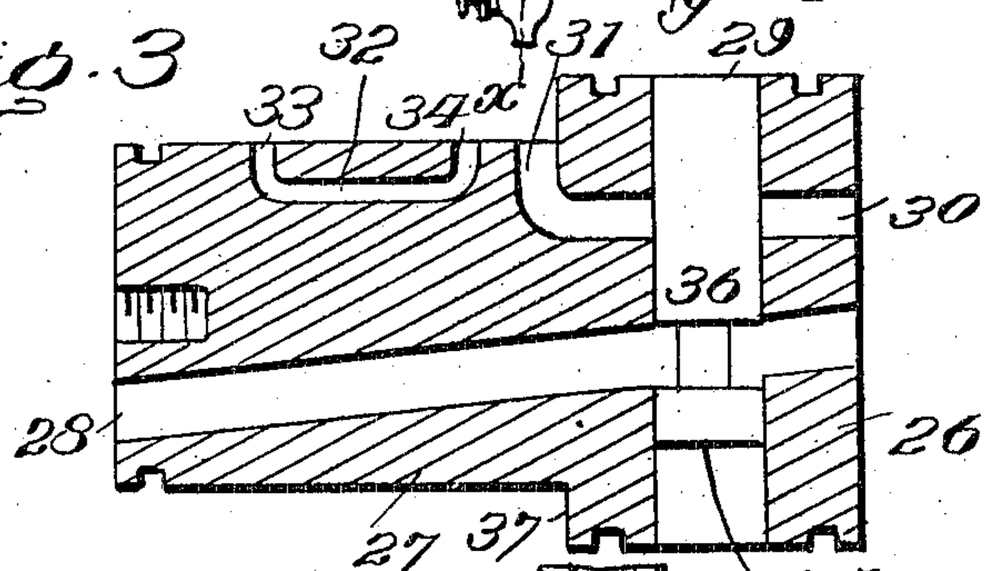
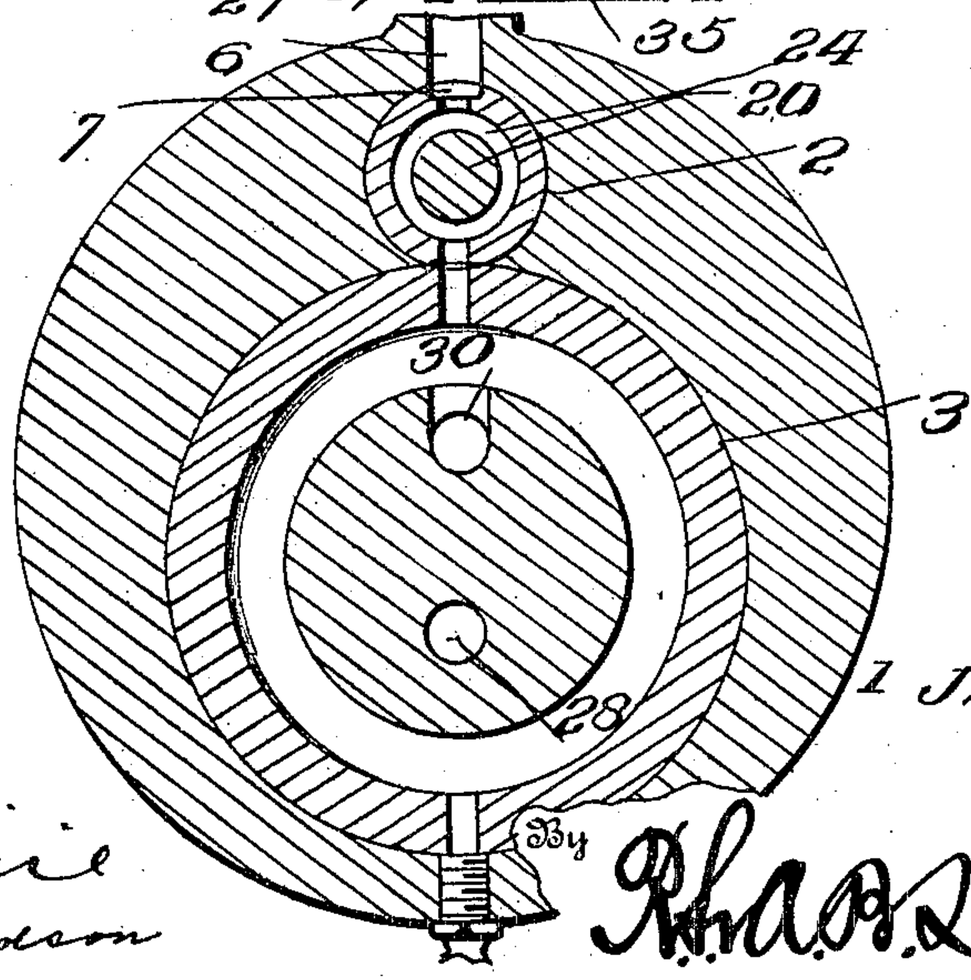


FIG. 4.



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3 SHEETS—SHEET 3.

FIG. 6.

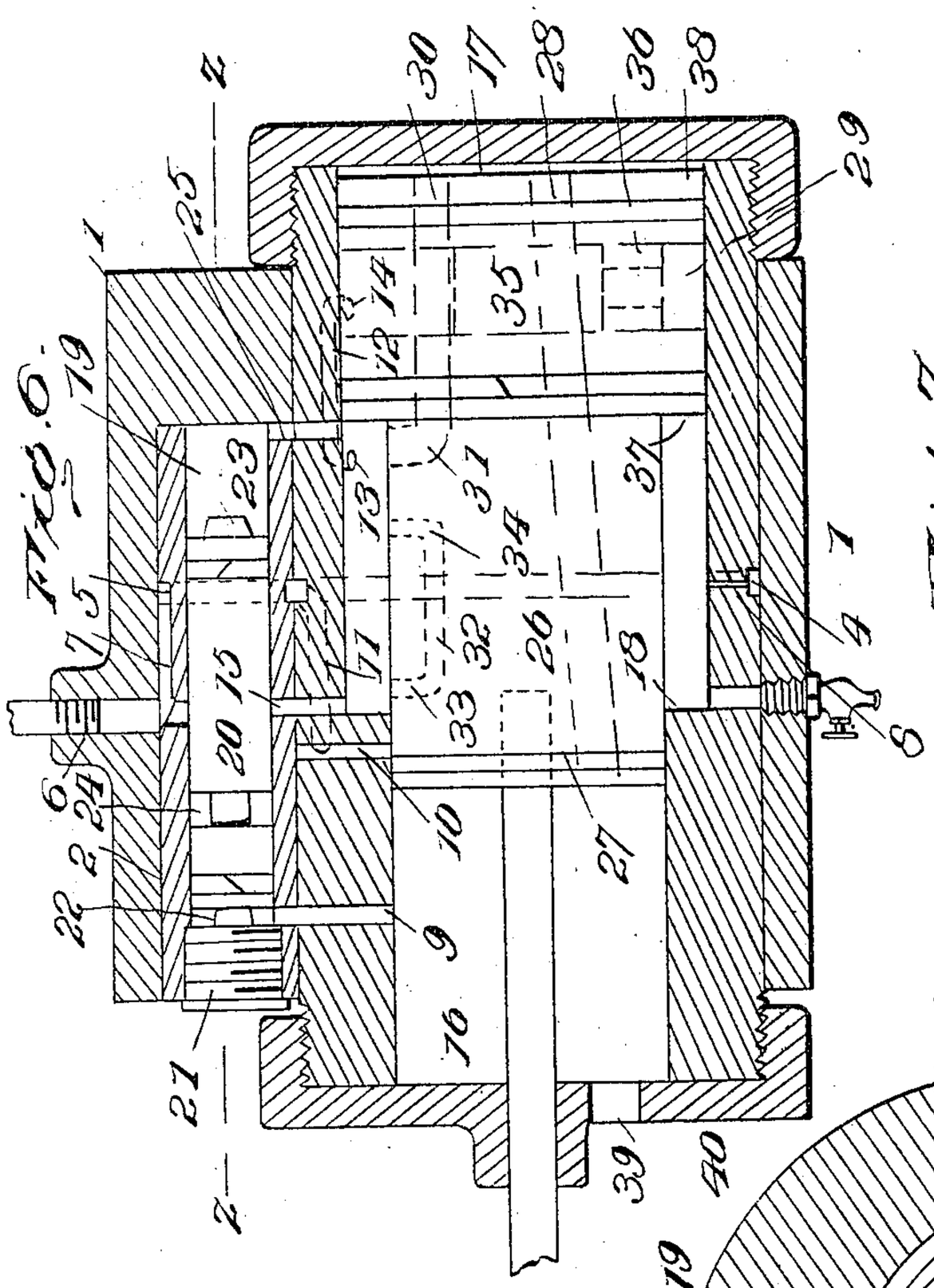


FIG. 7.

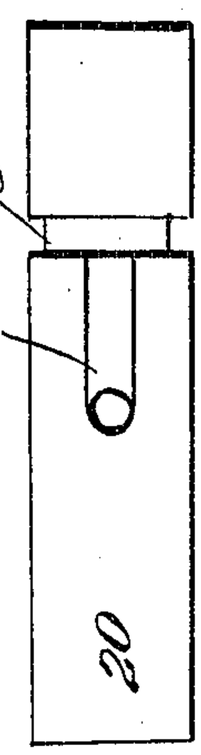
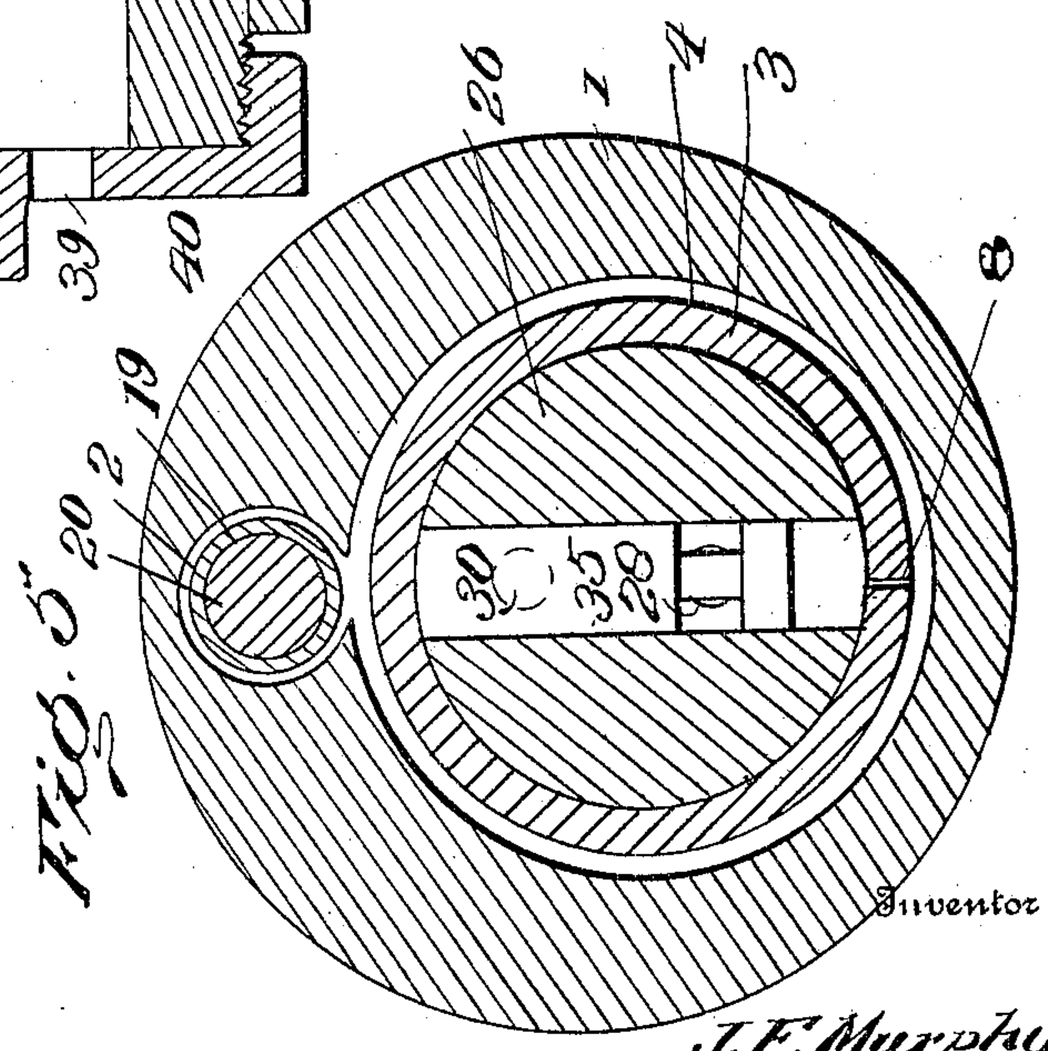


FIG. 5.



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UNITED STATES PATENT OFFICE.

JOSEPH F. MURPHY, OF ENNIS, TEXAS.

STEAM-ENGINE.

No. 812,353. Specification of Letters Patent. Patented Feb. 13, 1906

Application filed March 29, 1905. Serial No. 252,693.

To all whom it may concern:

Be it known that I, JOSEPH F. MURPHY, a citizen of the United States, residing at Ennis, in the county of Ellis and State of Texas, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

This invention relates to steam-engines of the reciprocating type, the purpose being to simplify the construction, reduce the number of working parts, economize in fuel, and to utilize the steam so as to obtain a maximum percentage of power therefrom.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the result reference is to be had to the following description and accompanying drawings.

While the invention may be adapted to different forms and conditions by changes in the structure and minor details without departing from the spirit or essential features thereof, still the preferred embodiment is shown in the accompanying drawings, in which—

Figure 1 is a side view of a steam-engine embodying the invention. Fig. 2 is a central longitudinal section showing the valves of the piston and cylinder in full and illustrating the relative position of the working parts when the piston is at the limit of its movement in one direction. Fig. 3 is a central longitudinal section of the piston and the valve mounted therein. Fig. 4 is a transverse section of the engine on the line *x x* of Fig. 2. Fig. 5 is a cross-section of the engine on the line *y y* of Fig. 2. Fig. 6 is a view similar to Fig. 2, showing the relation of the parts when the piston is at the limit of its stroke in the opposite direction. Fig. 7 is a plan view of the bushing in which the engine-valve operates. Fig. 8 is a sectional detail view of the engine-cylinder on the line *z z* of Fig. 6.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The main body or cylinder 1 of the engine may be constructed and finished in any desired manner and is provided with the several steam-ports essential to the operation of the engine. As a matter of convenience of construction and assembling of the parts the body or cylinder is provided with a bushing 2 and a lining 3, each being snugly fitted into openings formed in the body 1. An annular passage 4 is formed in the body or cylinder and is in communication with an annular passage 5 surrounding the bushing 2, the annular passage 5 in turn being in communication with the live-steam port 6 by way of longitudinal passage 7. The annular passage 4 is formed in the outer side of the lining 3 and is closed by the body or cylinder 1 when the lining is in position. The passage 5 is formed in the outer side of the bushing 2 and is closed by the wall of the bore or opening into which said bushing is fitted. The longitudinal passage 7 is formed by flattening or cutting away a part of the outer side of the bushing. A port 8 establishes communication between the passage 4 and the stays of the engine cylinder or lining. Corresponding openings 9 and 10 are formed in an end portion of the cylinder, the opening 10 being closed at its outer end by the bushing 2 and the opening 9 establishing communication between corresponding end portions of the bushing and cylinder. A passage 11 connects the opening 10 with the annular passages 4 and 5. A short passage 12 is formed in the opposite end portion of the cylinder and opens therein at 13 and 14. An opening 15 establishes communication between the cylinder and bushing.

The engine-cylinder has its end portions 16 and 17 of different diameters, a shoulder 18 being formed at the juncture of the two end portions. The opening 15 leads into the larger end portion 17 of the cylinder adjacent to the shoulder 18. The bore or space 19 of the bushing 2 constitutes a valve-chamber in which is slidably fitted the engine-valve 20, and the outer end of the bushing or valve-chamber is closed by means of a plug 21 threaded therein. Within the purview of the invention the body 1, bushing 2, and lining 3 may be integrally formed, the several steam-passages and parts being cored or otherwise formed therein; but it is preferred to bore the body 1 and provide the same with the bushing 2 and lining 3.

Abutments 22 and 23 are provided at opposite ends of the valve-chamber 19, the former being preferably an integral part of the plug 21 and the latter a part of the engine-valve 20. These abutments provide ample space for steam to find an entrance into end portions of the valve-chamber to exert pressure upon the ends of the valve 20.

The engine-valve 20 is provided at opposite ends with suitable packing to obtain a steam-tight fit within the valve-chamber 19 and is reduced at a point between its ends, as shown at 24, to provide a space to admit of unobstructed passage of steam from the inlet 6 through the openings 15 into the larger portion 17 of the engine-cylinder. An opening 25 is provided in an end portion of the engine-cylinder to establish communication between it and one end of the valve-chamber 19.

The piston 26 is provided with a reduced portion 27 for operation in the smaller end portion 16 of the cylinder, whereas the piston proper operates in the larger end portion 17. An opening 28 extends through opposite end portions of the piston and intersects with a transverse opening 29 and forms the exhaust-passage. Another opening 30 extends through the piston 26 and likewise intersects with the transverse openings 29 and curves abruptly at its inner end and extends through a side of the reduced portion 27, as shown at 31. A passage 32 is provided in the reduced portion 27 and opens through a side of said part at points 33 and 34, which are adapted to register with the respective openings 9 and 10 of the cylinder when the piston is at the limit of its stroke in one direction. A valve 35 is slidably mounted in the transverse opening 29 of the piston and is reduced at a point between its ends to form an annular passage 36, which is adapted to register with the exhaust-passage 28 and admit of the spent steam finding a ready discharge therethrough. The piston is packed in the usual way, so as to have a steam-tight fit within opposite end portions of the cylinder.

An engine constructed substantially as herein set forth and embodying the essential features of the invention is devoid of the usual valve mechanism and positive actuating means therefor, such as eccentrics and the like, and is operated solely by direct connection of the steam. When the piston is at the limit of its stroke in one direction, as shown in Fig. 2, the live steam has unobstructed entrance into the inner end portion of the enlarged parts 17 of the cylinder and exerts pressure upon the inner end 37 of the piston 26, so as to drive the same to the outer end of the space 17. When the piston is in the position shown in Fig. 2, the transverse opening 29 comes opposite to the opening 8, and the steam exerting a pressure upon one end of the piston-valve 35 forces it inward, so as to bring its space in register with the exhaust-passage 28 to admit of the steam confined between the piston 26 and the head 38 of the cylinder finding a ready discharge. At the same time the ends 33 and 34 of the passage 32 register with the openings 9 and 10, whereby steam from the passage 5 is adapted to enter the outer end of the valve-chamber 19, so as to force the piston-valve 20 inward to bring the passage 24 thereof in alinement with the inlets or ports 6 and 15. When the piston arrives at the opposite end of the cylinder, as shown in Fig. 6, the inner end 14 of the passage 12 registers with the opening 29 and the other end 13 of the passage 12 clears the inner end or face 37 of the piston, whereby steam has an unobstructed passage into the opening 29 and drives the piston-valve 35 in the opposite direction, so as to close the exhaust-passage 28 and uncover the passage 30, whereby the steam confined between the shoulder 18 and the piston-face 37 may by expansive force pass through the passage 31 and 30 to the opposite end or side of the piston and drive same in the opposite direction by low pressure or expansive force. At this instant the opening 25 is uncovered by the piston-face 37 clearing the same, thereby permitting steam to pass into the opposite end of the valve-chamber 19 and exerting a pressure upon the engine-valve 20 to drive the same toward the outer end of the valve-chamber, thereby interrupting direct entrance of steam into the cylinder through the opening 15. The low-pressure steam from the inner end of the cylinder-space 17 passing through the piston exerts a pressure thereon and drives the same back to the first position, as shown in Fig. 2, when the several operations hereinbefore described take place. However, a certain percentage of steam from the boiler will enter the left-hand end of the cylinder through the ports and passages 6, 7, 5, 4, and 8 and mingling with the steam therein will pass through the passage 31 30 to the right-hand end of the cylinder. Inasmuch as the port 8 is comparatively small the travel of the piston rapid, and the outer face of the piston comparatively large the amount of high-pressure steam entering through the port 8 is insignificant, although assisting in a measure in the return of the piston to the left-hand end of the cylinder. Is is further noted that the port 8 is closed by the piston after the same has made about one-half of its stroke from right to left. Practically considered, the piston is driven from right to left by the expansive force of the steam or low pressure. The term "low-pressure" steam is used to designate the force resulting from the expansion of the steam in the cylinder-space formed between the shoulder 18 and piston-face 37 after the valve 20 has operated to shut off the steam from the boiler. An opening 39 is formed in the head 40 of the cylinder and provides an outlet for the exhaust or spent steam. When the piston is driven to the right-hand end of the cylinder, the steam confined in the space 17 passes through the outlet 28 and escapes through openings 39. It will be understood that the head 40 may be dispensed with; but it is preferred to em-

ploy the same to exclude foreign matter from the end portion 16 of the cylinder, also to provide convenient attaching means for the guide-rods 41, upon which the cross-head 42 is mounted.

Having thus described the invention, what is claimed as new is—

1. In a steam-engine, the combination of the body provided with a working cylinder and a valve-chamber and having communicating passages, a piston arranged to operate in said cylinder and adapted to control certain passages and having a transverse opening and longitudinal openings intersecting said transverse opening, a valve mounted to slide in the transverse opening of the piston for controlling the longitudinal passages thereof and actuated at each end of the stroke of the piston by steam-pressure, and a valve mounted in the valve-chamber and moved therein by pressure of the steam controlled by the said piston.

2. In an engine, the combination of a cylinder provided with passages for admission of the steam or motive medium, a piston mounted in said cylinder and provided with corresponding passages, the one providing an outlet for the exhaust or spent steam and the other admitting the steam from one side of the piston to the other for operation by low pressure, said piston having a transverse opening intersecting the passages formed therein, a valve mounted in the transverse opening of the piston and positively actuated in each direction by pressure of the steam, and means for supplying steam or like motive medium to the cylinder for driving the piston.

3. In an engine of the type described, the combination of a cylinder having opposite end portions of different diameters and having a valve-chamber and provided with steam-passages, a piston mounted in the cylinder and comprising parts of different diameters corresponding to the end portions of the cylinder, the smaller portion of the piston having a passage to establish communication between one end of the valve-chamber and the steam-supply when the piston is at the limit of its stroke in one direction, and a valve transversely mounted in the piston and adapted to control passages thereof and positively actuated by direct steam-pressure.

4. In combination, an engine-cylinder and valve-chamber in communication by means of openings 9, 15 and 25 and having steam-passages 4, 11, 10, 5, 7 and 12, and having opening 8, a piston arranged in the cylinder and provided with a transverse opening and passages 30, 32 and 28, the passage 32 adapted to register with the openings 9 and 10 when the piston is at the limit of its stroke in one direction, a valve slidably mounted in the transverse opening of the piston, and a valve mounted in the aforesaid valve-chamber and adapted to be moved by direct steam-pressure controlled by the action of the piston.

5. A steam-engine comprising a body having openings corresponding to the cylinder and valve-chamber, a bushing fitted into the smaller opening and substituting the valve-chamber, a lining fitted in the larger opening and forming the working cylinder and having its end portions of different diameters, the bushing being provided with an annular passage 5 and longitudinal passage 7, and the lining having annular passage 4 in communication with passage 5 and formed with openings 8, 9, 10, 15 and 25 and with passage 12, a valve slidably mounted in the valve-chamber and having a portion between its ends reduced to form the passage 24, a piston having its end portions of different diameters and arranged to operate in the respective end portions of the cylinder and provided with passage 32, transverse opening 29 and passages 28 and 30 intersecting the transverse opening 29, and a valve mounted in the opening 29 and having a part between its ends reduced to form passage 36, the several parts being arranged to operate substantially in the manner set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH F. MURPHY. [L. S.]

Witnesses:
S. H. BOND,
HUGH STORY.